Exhibit D

1 IN THE UNITED STATES DISTRICT COURT

2 FOR THE EASTERN DISTRICT OF MISSOURI

3 EASTERN DIVISION

4

5

6 A.O.A., et al.,

7

8 Plaintiffs,

9

10 vs.   No. 4:11-cv-00044-CDP

11   (CONSOLIDATED)

12 DOE RUN RESOURCES

13 CORPORATION, et al.,

14

15 Defendants.

16

17

18 VIDEOTAPED VIDEOCONFERENCE Deposition

19 of SHAHROKH ROUHANI, Ph.D., PE

20 Taken on April 14th, 2021

21

22

23

24

25

Shahrokh Rouhani, Ph.D., P.E. - April 14, 2021
A.O.A., et al. vs DOE RUN RESOURCES CORPORATION , et al.,

1   IN THE UNITED STATES DISTRICT COURT

2   FOR THE EASTERN DISTRICT OF MISSOURI

3   EASTERN DIVISION

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5 A.O.A., et al.,

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9 vs.   No. 4:11-cv-00044-CDP

10   (CONSOLIDATED)

11 DOE RUN RESOURCES

12 CORPORATION, et al.,

13

14 Defendants.

15

16   VIDEOTAPED VIDEOCONFERENCE DEPOSITION OF

17 SHAHROKH ROUHANI, Ph.D., PE, taken on behalf of the

18 Plaintiffs, all parties attending by Zoom

19 videoconference, on the 14th day of April, 2021,

20 before Gretta G. Cairatti, RPR, CRR, MO-CCR #790,

21 IL-CSR #084-003418.

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Shahrokh Rouhani, Ph.D., P.E. - April 14, 2021
A.O.A., et al. vs DOE RUN RESOURCES CORPORATION , et al.,

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Shahrokh Rouhani, Ph.D., P.E. - April 14, 2021
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Shahrokh Rouhani, Ph.D., P.E. - April 14, 2021
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 1                     I N D E X
              SHAHROKH ROUHANI, PHD, PE
 2                  April 14, 2021

 3

 4
   EXAMINATION OF SHAHROKH ROUHANI, PHD, PE:
 5
           Examination by Ms. Wilkins              7
 6

 7

 8                DEPOSITION EXHIBITS
              SHAHROKH ROUHANI, PHD, PE
 9                  April 14, 2021

10

11    NUMBER            DESCRIPTION            MARKED

12    1      Supplemental Expert Report of     8
             Shahrokh Rouhani, Ph.D., P.E.,
13           dated March 19, 2021

14    2      2017 EPA Guidance                  24

15    3      USEPA NAAQS Table                  73

16    4      Meteorology and Atmospheric        137
             Physics article titled Air
17           quality model performance
             evaluation, J.C. Chang and
18           S.R. Hanna

19

20
             Errata                             152
21
             Witness Signature                  154
22

23

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 1 that changed?

 2   A.   Correct.

 3   Q.   I'm sorry, there was some background

 4 noise. Did you say correct?

 5   A.   Yes.

 6   Q.   Okay. Other than maybe having done some

 7 air modeling in graduate school, you previously

 8 testified that you have not performed air modeling

 9 in your career. Is that still accurate?

10   A.   As is stated in my CV, I have done

11 research on air modeling in the past for EPA. So in

12 addition to those that I did in grad -- during my

13 graduate studies, I also conducted air modeling for

14 EPA years ago.

15   Q.   So you -- you conducted the air modeling,

16 created the air model yourself. Is that what you're

17 telling me now?

18   A.   I believe so. It's all stated in my CV,

19 which is part of my expert report. If you go to --

20 it was in my original report that contained my CV

21 and part of that was the -- some -- the air modeling

22 investigation that I did years ago.

23   Q.   And how many years ago was that?

24   A.   I would say that it was roughly 25 years

25 ago. I was still at Georgia Tech.

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1   Q.   Okay. And that was during graduate

2 school?

3   A.   No, that was during the time that I was a

4 faculty, tenured faculty, at Georgia Tech.

5   Q.   Okay. You are not trained to run

6 CALPUFF, are you?

7   A.   No.

8   Q.   And you're not trained to understand the

9 results of CALPUFF?

10   MR. WILL: Object to form. Vague.

11   THE WITNESS: I was not trained to

12   use CALPUFF.

13 QUESTIONS BY MS. WILKINS:

14   Q.   In your deposition a little over a year

15 ago, you testified that, in your career, you've

16 never applied EPA air modeling protocols in your

17 work. Is that still accurate?

18   A.   Do you mean CALPUFF?

19   Q.   No, I'm talking about the EPA protocols

20 that advise how to perform air modeling.

21   A.   I'm very --

22   MR. WILL: Object to form. Vague.

23   THE WITNESS: I'm very familiar with

24   those -- with those -- the guidance document

25   and I've cited them both in my original expert

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1   report as well as in my supplemental report.

2 QUESTIONS BY MS. WILKINS:

3   Q.   Aside from in this case, have you ever

4 applied the type of statistical analysis that you're

5 doing here to an air model in -- in any other time

6 in your career?

7   A.   If -- if you mean that comparison of

8 predicted value versus measured value, that's a

9 standard procedure that I -- that I've used in air

10 modeling work that I did while I was at Georgia

11 Tech.

12   Q.   While you were at Georgia Tech, did you

13 compare in time and space predicted values from an

14 air model to measured values?

15   A.   Correct.

16   Q.   Do you hold yourself out to have an

17 expertise in air quality modeling?

18   A.   No.

19   Q.   Do you have expertise in the collection

20 of the measured air quality data used in air

21 modeling?

22   A.   Can you clarify your question? What do

23 you -- do you mean the actual measurement

24 techniques?

25   Q.   Well, we'll ask you that. Do you have --

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1   A.   Okay.

2   Q.   -- expertise in the measurement

3 techniques for collecting air quality data that's

4 used in air quality models?

5   A.   No.

6   Q.   Do you have expertise in determining

7 whether measured air concentrations used in air

8 quality models accurately reflects the air

9 concentrations where they were collected?

10   A.   If you mean that by quantitative

11 assessment of a model, yes.

12   Q.   No, what I'm asking you is, do you have

13 any expertise in determining whether the data that

14 you get from an air monitor is accurate?

15   A.   When -- let me put it this way. By -- my

16 expertise is on environmental statistics and I am

17 validating -- or evaluating a model by comparing its

18 predicted values to measured values. Within that

19 context, I'm very much an expert.

20   Q.   So my question is about specifically the

21 data that's collected from the air monitors. Are

22 you an expert in evaluating whether air monitors are

23 accurately reporting the air concentrations in the

24 location where they are sited?

25   A.   I'm not an expert in air monitoring

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1   A.   Times? I mean, calibration is not

2 something that you can count it as 1, 2, 3, 4 times.

3 You -- when you present a model as part of this

4 generic development, a calibration is involved. And

5 it's usually, a lot of times, is an involved

6 process. So it's not a one-time step. You adjust

7 certain parameters and see how the model is doing.

8 You go through many iterations until you reach a

9 model that you view as being reliable.

10   Q.   How many models have you performed

11 calibration on that you have created?

12   A.   I mean, it's really many. I -- I cannot

13 even count it. Only -- probably my CV would be the

14 best indication of that.

15   Q.   Okay. I'm asking you about models that

16 you, Dr. Rouhani, air models that you have created.

17   A.   Oh, air models.

18   Q.   How many of those have you performed

19 model calibration on?

20   A.   Every time -- you know, as I said, I did

21 that work with USEPA when I was at Georgia Tech. I

22 also did another air modeling for Atlanta, and this

23 was, I remember it, it was in 1996. It was as part

24 of the Olympic activity. And each time, calibration

25 was a generic part of my procedure.

1   are the elements that the modelers are taking

2   into account.

3 QUESTIONS BY MS. WILKINS:

4   Q.   Is it your opinion that you don't need to

5 take those factors into account when you're

6 evaluating the performance of an air model?

7   A.   I'm assuming that the modelers have done

8 their best to generate a reliable, or as reliable a

9 model, as possible, and for that purpose, they've

10 taken those adequately into account.

11   Q.   And it's outside of your area of

12 expertise to consider factors such as weather, or

13 wind direction, or wind speed when you are

14 statistically evaluating the performance of an air

15 quality model.

16   Do you agree with that?

17   MR. WILL: Object to form. Assumes

18   facts not established.

19   THE WITNESS: The focus of my review

20   in this case was to look at the performance of

21   Mr. Sullivan's models based on the results

22   that he provided and based on measured values

23   that he also provided.

24 QUESTIONS BY MS. WILKINS:

25   Q.   Okay. Would you agree that weather, wind

1   Q.   Other than in this case, have you ever

2 evaluated an air model by comparing measured data at

3 a specific time and location to the model for that

4 time and location?

5   A.   I believe that there were a number of

6 confidential studies that I did, modeling was done

7 by somebody else, but I compared it to the actual

8 measured values to assess the reliability of those

9 model results.

10   Q.   About how many occasions have you done

11 that?

12   A.   Right now, 2, 3, you know, half a dozen

13 comes to my mind.

14   Q.   Were those all in the context of

15 litigation?

16   A.   They were -- many of them were within the

17 context of permitting.

18   Q.   And in those occasions, do I understand

19 correctly that what you were doing was what I'm

20 calling pairing in space and time, which, I mean,

21 taking a measured air quality data point and

22 comparing it to the same modeled point for that time

23 and location?

24   A.   It included that, too, yes.

25   Q.   Okay. So in those 2 or 3 or half dozen

1 occasions where you have evaluated an air quality

2 model by comparing a measured data point to a

3 modeled data point at a particular time and

4 location, have you ever found good correspondence

5 between modeled measured data?

6   A.   In -- in those locations, the situation

7 that I was looking at, there were a few of them that

8 agreements were within acceptable ranges, and in

9 some cases they were not.

10   Q.   What do you determine to be an acceptable

11 range?

12   A.   For example, if the objective was to have

13 an estimate of a particular statistic such as annual

14 mean average, something like that, then compared to

15 the observed values, if it was within 10 percent,

16 20 percent, I would have considered that as being

17 reasonable; reasonably reliable.

18   Q.   And you're talking about an annual mean

19 average but what I'm asking you about is what you

20 did here when you compared a measured data at a

21 particular time and location to the modeled value

22 for that time and location, not an annual average,

23 not a monthly average, but the specific data point.

24 In these prior instances, have you done that?

25   A.   In one of the cases I recall that the

```
 1        entirely non-responsive.
 2 QUESTIONS BY MS. WILKINS:
 3     Q.     You're an expert in statistics; right?
 4     A.     Yes.
 5     Q.     Okay.  Would you agree that when you plot
 6 7- to 800 data points that have a lot of
 7 variability, a problem that you often encounter is a
 8 clustering effect that doesn't allow you to see,
 9 visually, the relationship between the factors that
10 you're plotting?
11     A.     First of all, let me correct you.  We
12 don't have 700 measured plotted dots here.  We only
13 have about 120.
14            And then number 2, I answered your
15 question, that is the reason that we rely on
16 quantitative measures such as R-squared.
17     Q.     Okay.  So your plot on the left only
18 contains 120 data points?
19     A.     Roughly, yes, because these are -- in
20 2007, I believe that there were roughly about 120
21 lead measurements.
22     Q.     So the data points on your X axes, on
23 your left plot in black, come from where?
24     A.     Both the predicted and measured values
25 come from Mr. Sullivan's Excel files.
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1   Q.   Okay. So it's your opinion, then, that

2 the statement here by the EPA that this variability

3 is one of the reasons that we discourage placing too

4 much weight on modeled versus predicted

5 concentrations paired in time and space and modeled

6 performance evaluations is not applicable to your

7 work?

8   A.   I have not reviewed this so I can not

9 open -- opine one way or another.

10   Q.   Okay. Well, I'd like you to take the

11 time to review it as you need to and then tell me

12 whether the statement that I just read is applicable

13 to the work you did in this case.

14   A.   I -- frankly, I need to know what ADJ_U*

15 option in AERMET is, and I think it will take a lot

16 longer than a few minutes to figure out what is

17 that. So if you want, you know, I can read the

18 paragraph and my answer will be that I need to

19 review this model, the comments, and then I can

20 opine about the significance of the statement, the

21 response stated.

22   Q.   Why didn't you review this section of the

23 EPA guidance in preparation of your report?

24   A.   I didn't see it. Nobody directed --

25 nobody asked me to review every model that EPA has

1   Q.   All right. Are you familiar with Weil,

2 et al., 1992?

3   A.   Yes.

4   Q.   Okay. Did you review that for your work

5 in this case?

6   A.   No.

7   Q.   Why are you familiar with it?

8   A.   Oh, I'm sorry, I'm sorry, I misstated.

9 I'm not familiar with the Weil, et al., article or

10 whatever it is.

11   Q.   Okay. Other than the EPA guidance, is it

12 correct that you did not review any articles or

13 other sources that addressed evaluation of air

14 quality models?

15   A.   I basically reviewed Mr. Sullivan's

16 report. He cited specific EPA guidance documents

17 and I basically relied on those in order to make my

18 review of Mr. Sullivan's model as unbiased as

19 possible.

20   Q.   Okay. And I want to make sure I

21 understand, also, that evaluation of air quality

22 models is not a typical thing that you do within

23 your work; right?

24   A.   Yes.

25   Q.   Okay. And the only other times that

1 you've ever evaluated performance of air quality

2 models was once about 25 years ago, and then

3 possibly again in the '90s?

4   A.   Yes, and then a series of confidential

5 studies.

6   Q.   Well, in those series of confidential

7 studies, did you evaluate air quality model

8 performance?

9   A.   I basically evaluated their reliability.

10   Q.   And that was two or three occasions?

11   A.   I would say half a dozen.

12   Q.   And when was that?

13   A.   These were scattered around the last 6 to

14 7 years.

15   Q.   When was the most recent one?

16   A.   I will say it was last year.

17   Q.   And when you did those -- work in those

18 half a dozen cases, did you review any guidance

19 sources other than EPA documents to advise you on

20 the appropriate way to evaluate air quality models?

21   A.   I -- as I said, in this case, I've cited

22 all the guidance documents that I've referenced, and

23 these are basically references that Mr. Sullivan

24 used in his work.

25   Q.   I'm not talking about this case. I'm